Performance Monitoring Protocol (QA/QC) for ICP-MS

1 Scope

This document addresses the performance monitoring (QA/QC) of the Inductively Coupled Plasma-Mass Spectrometer (ICP-MS). This document applies to personnel using the associated instrument(s)/equipment in the following disciplines/categories of testing: Toxicology, explosives (chemistry), and Chemistry Unit general physical and chemical analysis.

2 Principle

The ICP-MS system is comprised of an Inductively Coupled Plasma-Mass Spectrometer with a collision cell. Definitions and guidelines for following this protocol are outlined in the "General Instrument Maintenance Protocol."

3 Equipment/Materials/Reagents

a. Instrumentation – Thermo-Fisher ICAP Q with collision cell

b. Plasma Gas - Argon, 99.996% (Arcet or equivalent)

c. Helium – 99.9999% (Arcet or equivalent)

d. Thermo Tune-B solution or equivalent (Thermo or equivalent)

e. Thermo Setup solution or equivalent (Thermo or equivalent)

f. 50 mL polypropylene test tubes

4 Standards and Controls

4.1 Tuning Solution

The Thermo Setup solution is used for tuning the mass spectrometer.

4.2 Performance Verification Standard

The Thermo Tune-B solution is analyzed daily to assess operating performance, mass assignment, and continued integrity of the system. The Thermo Tune-B solution will be evaluated prior to the analysis of evidence. This solution will also be used to tune the source of the ICP-MS.

5 Sampling or Sample Selection

Not applicable.

6 Procedures

The following steps will be performed when the instrument will be in use. Enter the appropriate information in the QA/QC log to indicate completion. Refer to the manufacturer's instrument manuals as needed if any parts require cleaning or replacement.

a. Check the remaining disk space on the hard drive. Use Windows Explorer program to verify that the hard disk has at least 100 MB of free disk space. Do not use if less than 100 MB remain.

b. Verify that the argon line has 80 p.s.i. or above.

c. Check the torch to see if there is any visible residue or discoloration present. Clean the torch if it is dirty.

d. Check the sampler cone for dirt/residue build up. Clean the cones if they are dirty.

e. Check the sample pump tubing to verify that it is in good working condition (i.e., no flat spots or blockages present). Change the pump tubing as needed.

f. Check the color of the pump oil.

g. Perform an analysis of the Performance Verification Standard using Thermo Tune-B solution. Open the appropriate instrument protocol and start the analysis. The report from the daily performance check will appear on the screen. Print and evaluate the results based on the 'Decision Criteria' section of this procedure.

h. If all requirements are within specification, prepare the documentation as outlined in the "General Instrument Maintenance Protocol." If any requirements fail, check the condition of the peristaltic pump tubing, the condition of the cones, and the torch and injector position/cleanliness. Most performance problems arise from the condition of

the sample introduction system, torch, or cones. Significant changes in mass intensities, oxide ratios, doubly charged ion ratios, or increases in background may indicate the need to initiate further optimization procedures or maintenance procedures. Refer to the manufacturer's instrument manuals for details. If those measures are unsuccessful, contact appropriate instrument support personnel.

7 Instrumental Conditions

Conditions are preset in the system based on the tune.

8 Decision Criteria

8.1 Performance Verification Standard

Verify the results of the daily Performance Verification Standard

Background:	< 1 cps @ Mass 4.5
Background:	< 3 cps @ Mass 220
Li Sensitivity:	> 25,000 cps
Co Sensitivity:	> 50,000 cps
In Sensitivity:	> 110,000 cps
U Sensitivity:	>150,000 cps
CeO/Ce:	≤ 0.03
Ba^{2+}/ Ba^{+}:	≤ 0.03
Li, Co, In, and U Stability:	≤ 3%

8.2 Performance Verification Kinetic Energy Discrimination (KED)

Verify the results of the daily Performance Verification KED.

Background:	< 1 cps @ Mass 4.5
Background:	< 3 cps @ Mass 220
Co Sensitivity:	> 15,000 cps
In Sensitivity:	> 15,000 cps
U Sensitivity:	> 40,000 cps
Co/ClO:	> 18
CeO/Ce :	≤ 0.02
Li, Co, In, and U Stability:	≤ 3%

9 Calculations

Not applicable.

10 Measurement Uncertainty

Not applicable.

11 Limitations

Only properly trained personnel will perform duties involved in the operation, maintenance, or troubleshooting of this instrument.

12 Safety

The current instrument model contains safety interlocks to prevent the torch box from being opened while the plasma is ignited. Do not attempt to defeat the interlock.

Take standard precautions for the handling of all chemicals, reagents, and standards. Refer to the *FBI Laboratory Safety Manual* for the proper handling and disposal of all chemicals. Personal protective equipment should be used when handling any chemical and when performing any type of analysis. Many instrument components are held at temperatures of 250°C and higher. Precautions should be taken to prevent the contact of skin with heated surfaces and areas.

13 References

Manufacturer's Instrument Manuals for the specific models and accessories used.

"General Instrument Maintenance Protocol" (Inst 001) *Instrument Operation and Systems Support SOP Manual.*

"Mass Spectrometer General Maintenance Protocol" (Inst 004) *Instrument Operation and Systems Support SOP Manual.*

FBI Laboratory Safety Manual.

Rev. #	Issue Date	History
0	03/18/15	New document that replaces a previous document entitled "Performance Monitoring Protocol (QA/QC) for the Perkin Elmer ICP-MS."
1	10/04/18	Updated Section 1 Scope to include applicable disciplines/categories of testing. Updated heading in Section 5. Added 'appropriate instrument support personnel' to Section 6 h. Added statement regarding instrument conditions in Section 7. Updated 'Instrument Operation and Systems Support' in Section 13 and header.

Approval

Redacted - Signatures on File

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